

**SYNTHESIS AND CHARACTERIZATION OF PALM BASED
POLYURETHANE FOAM WITH CELLULOSE AS A FILLER**

NURIAH SYUHADA BINTI MOHD SALLEH

**Final Year Project Report Submitted in
Partial Fulfilment of the Requirements for the
Degree of Bachelor of Science (Hons.) Chemistry
In the Faculty of Applied Sciences
Universiti Teknologi MARA**

JANUARY 2016

This Final Year Project Report entitled **“Synthesis and Characterization of Palm Based Polyurethane Foam with Cellulose as a Filler”** was submitted by Nuriah Syuhada Binti Mohd Salleh, in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Chemistry, in the Faculty of Applied Sciences, and was approved by

Jamil Mohamed Sapari
Supervisor
School of Chemistry and
Environmental Studies
Faculty of Applied Sciences
Universiti Teknologi MARA
72000 Kuala Pilah
Negeri Sembilan

Tn Sheikh Ahmad Izaddin Sheikh
Mohd Ghazali
Project Coordinator
School of Chemistry and
Environmental Studies
Faculty of Applied Sciences
Universiti Teknologi MARA
72000 Kuala Pilah
Negeri Sembilan

Mazni Musa
Head of Programme
School of Chemistry and
Environmental Studies
Faculty of Applied Sciences
Universiti Teknologi MARA
72000 Kuala Pilah
Negeri Sembilan

Date: _____

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	III
TABLE OF CONTENTS	IV
LIST OF TABLES	VI
LIST OF FIGURES	VII
LIST OF ABBREVIATIONS	IX
ABSTRACT	XI
ABSTRAK	XII
CHAPTER 1 INTRODUCTION	1
1.1 Background of study	1
1.2 Problem statement	3
1.3 Objectives of study	4
1.4 Significance of study	4
CHAPTER 2 LITERATURE REVIEW	5
2.1 Polyurethane	5
2.2 Preparation of polyurethane	6
2.2.1 Petroleum-based polyurethane	8
2.2.2 Soybean oil-based polyurethane	9
2.2.3 Castor oil-based polyurethane	10
2.2.4 Palm oil-based polyurethane	10
2.3 Cellulose	12
2.3.1 Structure of cellulose	14
2.4 Polyurethane with cellulose as a filler	15
2.5 Polyurethane with other fillers	18
CHAPTER 3 METHODOLOGY	20
3.1 Materials	20
3.2 Methods	20
3.2.1 Preparation of monoester-OH PKO	22
3.2.2 Cellulose	23
3.2.3 Preparation of PU-Cel foam	23
3.2.4 Characterization of PU-Cel foam	24
CHAPTER 4 RESULTS AND DISCUSSIONS	26
4.1 Preparation of monoester-OH palm kernel oil (PKO)	26
4.2 Monoester-OH PKO	26
4.3 Cellulose	29
4.4 PU-Cellulose (PU-Cel) foam	30
4.5 Chemical characterization of PU-Cel foam	32

4.5.1	Fourier transform infrared (FTIR) analysis	32
4.6	Mechanical characterization of PU-Cel foam	34
4.6.1	Density of PU-Cel foam	34
4.6.2	Hardness of PU-Cel foam	39
4.7	Physical characterization of PU-Cel foam	42
4.7.1	Morphology observation	42
 CHAPTER 5 CONCLUSION AND RECOMMENDATION		47
5.1	Conclusion	47
5.2	Recommendations	48
 CITED REFERENCES		49
APPENDICES		63
CURRICULUM VITAE		65

ABSTRACT

SYNTHESIS AND CHARACTERIZATION OF PALM BASED POLYURETHANE FOAM WITH CELLULOSE AS A FILLER

The study is carried out to produce and characterize of polyurethane foam with cellulose (PU-Cel) from palm kernel oil-based polyol. Polyurethane was produced by reacting monoester-OH palm kernel oil with 2,4-diphenylmethane diisocyanate in the ration of 1 : 1. Addition of cellulose in polyurethane system was at 10 %, 20 %, 30 % and 40 % by weight to the polyurethane system and then was mixed using the mechanical stirrer. Mechanical properties of PU-Cel foam were tested by using density test and hardness test. Morphological of PU-Cel foam were observed by using microscope. It found that the optimum mechanical properties of PU-Cel foam achieved with increased amount of cellulose up to 30 % part by weight. Based on the micrograph analysis, 30 % cellulose in the PU-Cel foam showed uniform dispersion. Addition of cellulose was necessary to increase the mechanical properties of PU-Cel foam based palm kernel oil.